

Claims

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1. A tube (14) for conveying coolant through a heat exchanger (10), the tube having a flattened cross-section with two major opposing walls and internal projections (30) on the major opposing walls (18,20), the projections extending into the internal cross-sectional area of the tube to interfere with the flow of coolant along the tube, characterised in that each projection (30) extends across less than 30% of the width of the tube and the area of the tube walls (18,20) having projections amounts to less than 7.5% of the total area of the tube walls.
2. A tube as claimed in Claim 1, wherein the area of the tube walls (18,20) having projections amounts to less than 7.5% of the total area of the tube walls and more than 1% of the total area of the tube walls.
3. A tube as claimed in Claim 1 or Claim 2, wherein the area of the tube walls (18,20) having projections amounts to less than 5% of the total area of the tube walls.
4. A tube as claimed in Claim 1 or Claim 2, wherein the area of the tube walls (18,20) having projections amounts to approximately 2.5% of the total area of the tube walls.
5. A tube as claimed in any preceding claim, wherein the projections (30) are in the form of dimples (32) formed in the tube walls (18,20), the dimples having substantially equal dimensions in the direction of coolant flow and transverse to the direction of flow.

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6. A tube as claimed in any preceding claim, wherein the projections (30) are arranged in groups and within each group, the projections are arranged on a line extending diagonally across the tube.
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7. A tube as claimed in Claim 6, wherein the line of projections (30) on one opposing wall (18) extends in a diagonally opposite direction to the line of projections (30) on the other opposing wall (20).
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8. A tube as claimed in Claim 6 or Claim 7, wherein the projections (30) on one opposing wall (18) are greater in number than the projections on the other opposing wall (20), and the projections on the one wall (18) are offset across the width of the tube from the projections on the other opposing wall (20).
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9. A tube as claimed in any preceding claim, wherein the projections (30) are in the form of indentations (32) punched out from one surface of the tube to appear as projections in the internal cross-section of the tube.
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10. A tube as claimed in any preceding claim, wherein the projections (30) are generally square or rectangular in plan view.
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11. A tube as claimed in any preceding claim, wherein the projections (30) have a length greater than their width, and the length of the projections is set at an angle to the length of the tube.
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12. A tube as claimed in any one of the preceding claims, wherein the depth of the projections (30) is between 35 and 50% of the internal diameter of the tube.

13. A heat exchanger having a heat exchange core (10) comprising a plurality of parallel coolant tubes (14) separated by heat exchange fins (16), wherein each of the tubes (14) has a flattened cross-section with two major opposing walls (18,20) and internal projections (30) on the major opposing walls, the projections extending into the internal cross-sectional area of the tube to interfere with the flow of coolant along the tube, characterised in that each projection (30) extends across less than 30% of the width of the tube (14) and the area of the tube walls having projections amounts to less than 7.5% of the total area of the tube walls.

14. A method of operating a heat exchanger in which coolant is conveyed through tubes (14) wherein each tube (14) has a flattened cross-section with two major opposing walls (18,20) and internal projections (30) on the major opposing walls, characterised in that the projections (30) extend into the internal cross-sectional area of the tube (14) to an extent such that laminar coolant flow is maintained within the tube over the normal operating range of the heat exchanger and wherein the laminar flow follows a path which is diverted from wall to wall and from side to side between the tube walls..